

CLAIMS

1. A display device comprising:
a first transistor including a first gate electrode;
5 a second transistor including a second gate electrode which is connected to a first drain electrode of the first transistor;
an insulating film provided so as to cover the first and the second transistors;
a first electrode of an electroluminescent layer, which is connected to a second drain electrode of the second transistor; and
10 a second electrode of the electroluminescent layer, which is provided over the electroluminescent layer.

2. A display device comprising:
a first transistor including a first gate electrode which is formed by a droplet
15 discharge method;
a second transistor including a second gate electrode which is connected to a first drain electrode of the first transistor;
an insulating film provided so as to cover the first and the second transistors;
a first electrode of an electroluminescent layer, which is connected to a second
20 drain electrode of the second transistor; and
a second electrode of the electroluminescent layer, which is provided over the electroluminescent layer.

3. A display device comprising:
25 a first transistor including a first gate electrode which is formed by a droplet discharge method;
a second transistor including a second gate electrode which is connected to a first drain electrode of the first transistor;
a first insulating film provided so as to cover the first and the second transistors;
30 a second insulating film containing nitrogen, which is formed so as to cover the

first insulating film;

a cathode of an electroluminescent layer, which is connected to a second drain electrode of the second transistor; and

an anode of the electroluminescent layer, which is provided over the
5 electroluminescent layer.

4. A display device comprising:

a first transistor including a first gate electrode which is formed by a droplet discharge method;

10 a second transistor including a second gate electrode which is connected to a first drain electrode of the first transistor;

a first insulating film provided so as to cover the first and the second transistors;

a second insulating film containing nitrogen, which is formed so as to cover the first insulating film;

15 a cathode of an electroluminescent layer, which is connected to a second drain electrode of the second transistor; and

an anode of the electroluminescent layer, which is provided over the electroluminescent layer,

wherein the cathode, an electron injection layer, an electron transport layer, a light emitting layer, a hole transport layer, and a hole injection layer are stacked in order
20 in the electroluminescent layer.

5. A display device according to any one of Claims 1 through 4,

wherein each of the first and the second gate electrodes is formed over an area
25 treated with base pretreatment.

6. A display device according to Claim 5,

wherein the base pretreatment is performed by using photocatalyst.

30 7. A display device according to any one of Claims 1 through 4,

wherein the first and the second gate electrodes and the first and the second drain electrodes each contain gold, silver, copper, platinum, palladium, tungsten, nickel, tantalum, bismuth, lead, indium, tin, zinc, titanium or aluminum.

5 8. A display device according to any one of Claims 2 through 4,
wherein ink-jet is used for the droplet discharge method.

 9. A display device according to any one of Claims 1 through 4,
wherein the first and the second transistor each include an amorphous
10 semiconductor or a semiamorphous semiconductor.

 10. A display device according to any one of Claims 1 through 4,
wherein a scan line is connected to the first gate electrode of the first transistor,
a signal line is connected to the first drain electrode of the first transistor, and
15 a protective circuit is provided for the scan line and the signal line.

 11. A television receiver in which a display screen comprises a display device
according to any one of Claims 1 through 4.

20 12. A method for fabricating a display device, comprising the steps of:
forming a first conductive film by applying a composition containing a
conductor;
forming a semiconductor film over the first conductive film;
forming second conductive films over the semiconductor film by applying a
25 composition containing a conductor, whereby a thin film transistor is formed;
forming a first insulating film so as to cover the thin film transistor,
forming a first electrode over the first insulating film,
forming a second insulating film so as to cover an end portion of the first
electrode;
30 forming an electroluminescent layer in an opening provided for the second

insulating film; and

forming a second electrode so as to cover the electroluminescent layer.

13. A method for fabricating a display device, comprising the steps of:

5 forming a first conductive film by a droplet discharge method;

forming a semiconductor film over the first conductive film;

forming second conductive films over the semiconductor film by a droplet discharge method, whereby a thin film transistor is formed;

forming a first insulating film so as to cover the thin film transistor,

10 forming a first electrode over the first insulating film,

forming a second insulating film so as to cover an end portion of the first electrode;

forming an electroluminescent layer in an opening provided for the second insulating film; and

15 forming a second electrode so as to cover the electroluminescent layer.

14. A method for fabricating a display device according to any one of Claims 12 and 13,

wherein the method further comprises a step of first base pretreatment to where
20 the first conductive film is formed before forming the conductive film.

15. A method for fabricating a display device according to any one of Claims 12 and 13,

wherein the method further comprises a step of second base pretreatment to
25 where the second conductive films are formed before forming the conductive films.

16. A method for fabricating a display device according to Claim 14,
wherein the first base pretreatment is performed by using photocatalyst.

30 17. A method for fabricating a display device according to Claim 15,

wherein the second base pretreatment is performed by using photocatalyst.

18. A method for fabricating a display device, comprising the steps of:

forming a first and a second gate electrodes by a droplet discharge method;

5 forming a semiconductor film over the gate electrodes;

forming masks over the semiconductor film;

patterning the semiconductor film using the masks;

forming a first and a second source electrodes and a first and a second drain
electrodes over the patterned semiconductor films by a droplet discharge method,
10 whereby thin film transistors are formed;

forming a columnar conductive film over the second source electrode or the
second drain electrode;

forming a first insulating film so as to cover the columnar conductive film and
the thin film transistors;

15 forming a first electrode so as to connect to the columnar conductive film over
the first insulating film;

forming a second insulating film so as to cover an end portion of the first
electrode;

forming an electroluminescent layer in an opening provided for the second
20 insulating film by a droplet discharge method; and

forming a second electrode so as to cover the electroluminescent layer.

19. A method for fabricating a display device, comprising the steps of:

forming a first and a second gate electrodes by a droplet discharge method;

25 forming a semiconductor film over the gate electrodes;

forming masks over the semiconductor film;

patterning the semiconductor film using the masks;

forming a first and a second source electrodes and a first and a second drain
electrodes over the patterned semiconductor films by a droplet discharge method,
30 whereby thin film transistors are formed;

- forming a first insulating film so as to cover the thin film transistors;
 - forming a contact hole in the first insulating film over the second source electrode or the second drain electrode;
 - forming a columnar conductive film in the contact hole;
 - 5 forming a first electrode so as to connect to the columnar conductive film;
 - forming a second insulating film so as to cover an end portion of the first electrode;
 - forming an electroluminescent layer in an opening provided for the second insulating film by a droplet discharge method; and
 - 10 forming a second electrode so as to cover the electroluminescent layer.
20. A method for fabricating a display device according to Claim 19, wherein the masks are formed over the first insulating film by a droplet discharge method, and
- 15 the contact hole is formed in the first insulating film by etching using the mask.
21. A method for fabricating a display device, comprising the steps of:
- forming a first and a second gate electrodes by a droplet discharge method;
- forming a semiconductor film over the gate electrodes;
- 20 forming masks over the semiconductor film;
- patterning the semiconductor film using the masks;
- forming a first and a second source electrodes and a first and a second drain electrodes over the patterned semiconductor films by a droplet discharge method, whereby thin film transistors are formed;
- 25 forming a first insulating film so as to form an opening over the second source electrode or the second drain electrode;
- forming a first electrode in the opening of the first insulating film;
- forming a second insulating film so as to cover a part of the first electrode;
- forming an electroluminescent layer in an opening provided for the second
- 30 insulating film by a droplet discharge method; and

forming a second electrode so as to cover the electroluminescent layer.

22. A method for fabricating a display device, comprising the steps of:

forming a first and a second gate electrodes by a droplet discharge method;

5 forming a semiconductor film over the gate electrodes;

forming masks over the semiconductor film;

patterning the semiconductor film using the masks;

forming a first and a second source electrodes and a first and a second drain
electrodes over the patterned semiconductor films by a droplet discharge method,
10 whereby thin film transistors are formed;

forming a columnar organic film over the second source electrode or the second
drain electrode;

forming a first insulating film so as to cover the columnar organic film and the
thin film transistors;

15 removing the columnar organic film;

forming a first electrode so as to connect to the second source electrode or the
second drain electrode over the first insulating film;

forming a second insulating film so as to cover an end portion of the first
electrode;

20 forming an electroluminescent layer in an opening provided for the second
insulating film by a droplet discharge method; and

forming a second electrode so as to cover the electroluminescent layer.

23. A method for fabricating a display device according to Claim 22,

25 wherein the first insulating film is repellent to the columnar organic film.

24. A method for fabricating a display device according to Claim 22,

wherein the columnar organic film is removed by water washing.

30 25. A method for fabricating a display device, comprising the steps of:

- forming a first and a second gate electrodes by a droplet discharge method;
- forming a semiconductor film over the gate electrodes;
- forming masks over the semiconductor film;
- patterning the semiconductor film using the masks;
- 5 forming a first and a second source electrodes and a first and a second drain electrodes over the patterned semiconductor films by a droplet discharge method, whereby thin film transistors are formed;
- forming an organic film which is repellent to a first insulating film on the surface of the second thin film transistor;
- 10 forming a mask over a part of the second source electrode or the second drain electrode;
- removing the organic film using the mask;
- forming an opening over the part of the second source electrode or the second drain electrode by forming the first insulating film after removing the mask;
- 15 forming a first electrode in the opening so as to connect to the second source electrode or the second drain electrode;
- forming a second insulating film so as to cover a part of the first electrode;
- forming an electroluminescent layer in an opening provided for the second insulating film by a droplet discharge method; and
- 20 forming a second electrode so as to cover the electroluminescent layer.

26. A method for fabricating a display device according to any one of Claims 18, 19, 21, 22 and 25,

- wherein the method further comprises a step of first base pretreatment to where
- 25 the first and the second gate electrodes are formed before forming the electrodes.

27. A method for fabricating a display device according to any one of Claims 18, 19, 21, 22 and 25,

- wherein the method further comprises a step of second base pretreatment to
- 30 where the first and the second source electrodes and the first and the second drain

electrodes are formed before forming the electrodes.

28. A method for fabricating a display device according to Claim 26,
wherein the first base pretreatment is performed by using photocatalyst.

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29. A method for fabricating a display device according to Claim 27,
wherein the second base pretreatment is performed by using photocatalyst.

30. A method for fabricating a display device according to any one of Claims 18,
10 19, 21, 22 and 25,

wherein channel protective films are formed in contact with the semiconductor
film over the first and the second gate electrode.

31. A method for fabricating a display device, comprising the steps of:
15 forming a first and a second source electrodes and a first and a second drain
electrodes by a droplet discharge method;

forming a semiconductor film over the first and the second source electrodes and
the first and the second drain electrodes;

forming masks over the semiconductor film;
20 patterning the semiconductor film using the masks;

forming a first and a second gate electrode over the patterned semiconductor
films by a droplet discharge method, whereby thin film transistors are formed;

forming a columnar conductive film over the second source electrode or the
second drain electrode;

25 forming a first insulating film so as to cover the columnar conductive film and
the thin film transistors;

forming a first electrode so as to connect to the columnar conductive film over
the first insulating film;

forming a second insulating film so as to cover an end portion of the first
30 electrode;

forming an electroluminescent layer in an opening provided for the second insulating film by a droplet discharge method; and

forming a second electrode so as to cover the electroluminescent layer.

5 32. A method for fabricating a display device according to Claim 31,
 wherein the method further comprises a step of first base pretreatment to where
 the first and the second source electrodes and the first and the second drain electrodes are
 formed before forming the electrodes.

10 33. A method for fabricating a display device according to Claim 31,
 wherein the method further comprises a step of second base pretreatment to
 where the first and the second gate electrodes are formed before forming the electrodes.

15 34. A method for fabricating a display device according to Claim 32,
 wherein the first base pretreatment is performed by using photocatalyst.

 35. A method for fabricating a display device according to Claim 33,
 wherein the second base pretreatment is performed by using photocatalyst.

20 36. A method for fabricating a display device, comprising the steps of:
 forming a first and a second gate electrodes of a first and a second transistors by
 a droplet discharge method;

 forming a semiconductor film over the first and the second gate electrodes with a
 gate insulating film therebetween;

25 forming a first and a second source electrodes and a first and a second drain
 electrodes of the first and the second transistors by a droplet discharge method over the
 semiconductor film;

 forming a contact hole for connecting the first source electrode or the first drain
 electrode of the first transistor to the second gate electrode of the second transistor by
30 etching the gate insulating film;

forming a conductive film in the contact hole by a droplet discharge method, whereby thin film transistors are formed;

forming a columnar conductive film over the second source electrode or the second drain electrode of the second transistor;

5 forming a first insulating film so as to cover the columnar conductive film and the first and the second thin film transistors;

forming a first electrode so as to connect to the columnar conductive film over the first insulating film;

10 forming a second insulating film so as to cover an end portion of the first electrode;

forming an electroluminescent layer in an opening provided for the second insulating film; and

forming a second electrode so as to cover the electroluminescent layer.

15 37. A method for fabricating a display device, comprising the steps of:

forming a first and a second gate electrodes of a first and a second transistors by a droplet discharge method;

forming a semiconductor film over the first and the second gate electrodes with a gate insulating film therebetween;

20 patterning the semiconductor film;

forming a first and a second source electrodes and a first and a second drain electrodes of the first and the second transistors by a droplet discharge method over the patterned semiconductor films;

25 forming a contact hole for connecting the first source electrode or the first drain electrode of the first transistor to the second gate electrode of the second transistor by etching the gate insulating film using the source electrode and the drain electrode;

forming a conductive film in the contact hole by a droplet discharge method, whereby thin film transistors are formed;

30 forming a columnar conductive film over the second source electrode or the second drain electrode of the second transistor;

forming a first insulating film by a droplet discharge method so as to cover the columnar conductive film and the first and the second thin film transistors;

forming a first electrode so as to connect to the columnar conductive film over the first insulating film;

5 forming a second insulating film so as to cover an end portion of the first electrode;

forming an electroluminescent layer in an opening provided for the second insulating film by a droplet discharge method; and

forming a second electrode so as to cover the electroluminescent layer.

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38. A method for fabricating a display device according to any one of Claims 36 and 37,

wherein the method further comprises a step of first base pretreatment to where the gate electrodes of the first and the second transistors are formed before forming the
15 electrodes.

39. A method for fabricating a display device according to any one of Claims 36 and 37,

wherein the method further comprises a step of second base pretreatment to
20 where the first and the second source electrodes and the first and the second drain electrodes of the first and the second transistors are formed before forming the electrodes.

40. A method for fabricating a display device according to Claim 38,
wherein the first base pretreatment is performed by using photocatalyst.

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41. A method for fabricating a display device according to Claim 39,
wherein the second base pretreatment is performed by using photocatalyst.

42. A method for fabricating a display device according to any one of Claims 12,
30 13, 18, 19, 21, 22, 25, 31, 36 and 37,

wherein a surface of the first insulating film is planarized by spraying a gas.

43. A method for fabricating a display device according to any one of Claims 12, 13, 18, 19, 21, 22, 25, 31, 36 and 37,

5 wherein the electroluminescent layer is formed by a droplet discharge method.

44. A method for fabricating a display device, comprising the steps of:

preparing a treatment system including a first treatment chamber for droplet discharge and a second treatment chamber for planarization;

10 forming a conductive film and an insulating film over an object by a droplet discharge method in the first treatment chamber;

transferring the object into the second treatment chamber without exposure to the atmosphere; and

15 planarizing the conductive film and the insulating film in the second treatment chamber.

45. A method for fabricating a display device according to Claim 44,

wherein each of the conductive film and the insulating film is formed over an area of the object treated with base pretreatment.

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46. A method for fabricating a display device according to Claim 45,

wherein the base pretreatment is performed by using photocatalyst.

47. A method for fabricating a display device according to any one of Claims 13,

25 18, 19, 20, 21, 22, 25, 31, 36, 37, 43 and 44,

wherein ink-jet is used for the droplet discharge method.